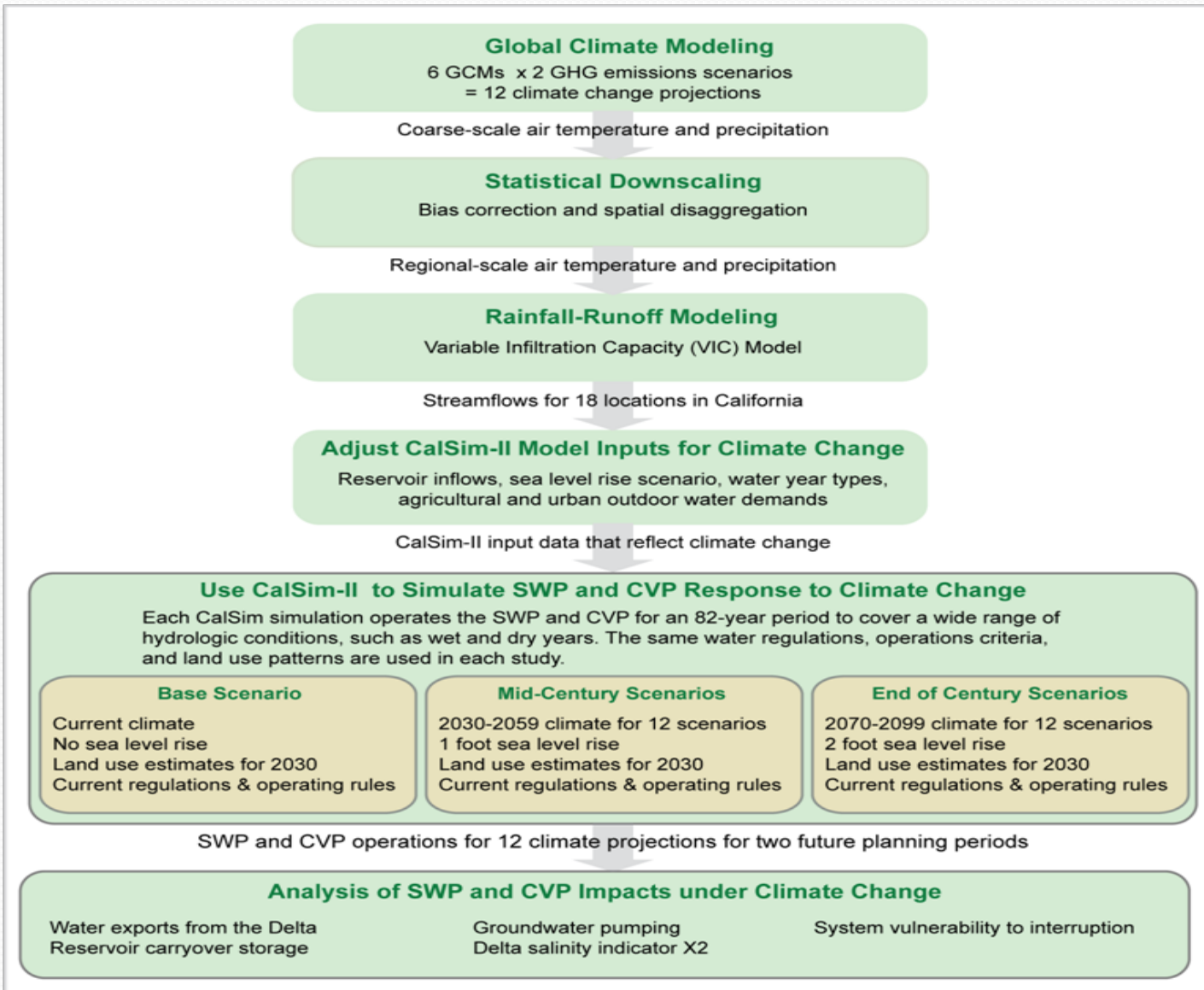


CalSim Climate Change Impact Assessment

Jianzhong (Jay) Wang, PhD, PE
Bay-Delta Office, DWR

CC impact Study Steps



Previous CC impact study in DWR

Table 20-1 Climate Change Studies by California Department of Water Resources

Study	Selection/Number of GCM Projections	Use of Unimpaired Rim Inflow under Climate Change
<i>Progress on Incorporating Climate Change into Planning and Management of California's Water Resources (DWR, 2006)</i>	Scenario Based/4	Indirect Use: One-Step Perturbation Ratio Method
<i>Using Future Climate Projections to Support Water Resources Decision Making in California (DWR, 2009)</i>	Scenario Based/12	Indirect Use: Three-Step Perturbation Ratio Method
<i>California Water Plan, Update 2009 (CWP,2009)</i>	Scenario Based/12	Direct Use
<i>OCAP BA (USBR, 2008)</i>	Scenario Based/4	Indirect Use: Two Step Perturbation Ratio Method
<i>BDCP: Appendix E2- Physical Modeling Methods (DWR, 2010)</i>	Ensemble Informed /112	Indirect Use: Variable Perturbation Ratio Method

Notes:

CWP = California Water Plan

DWR = California Department of Water Resources

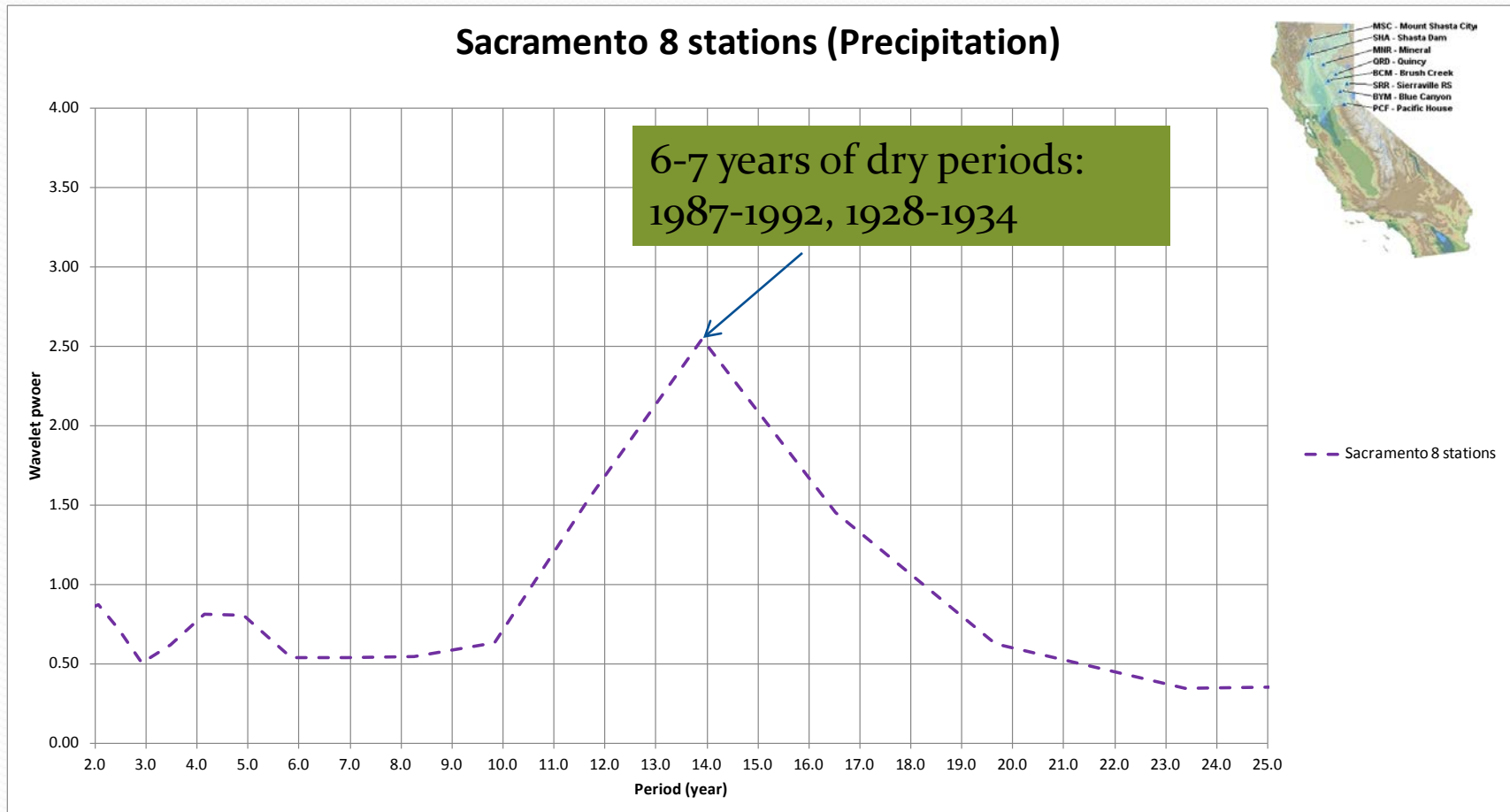
USBR = United States Bureau of Reclamation

GCM = Global Circulation Model

OCAP BA = Operating Criteria and Plan Biological Assessment

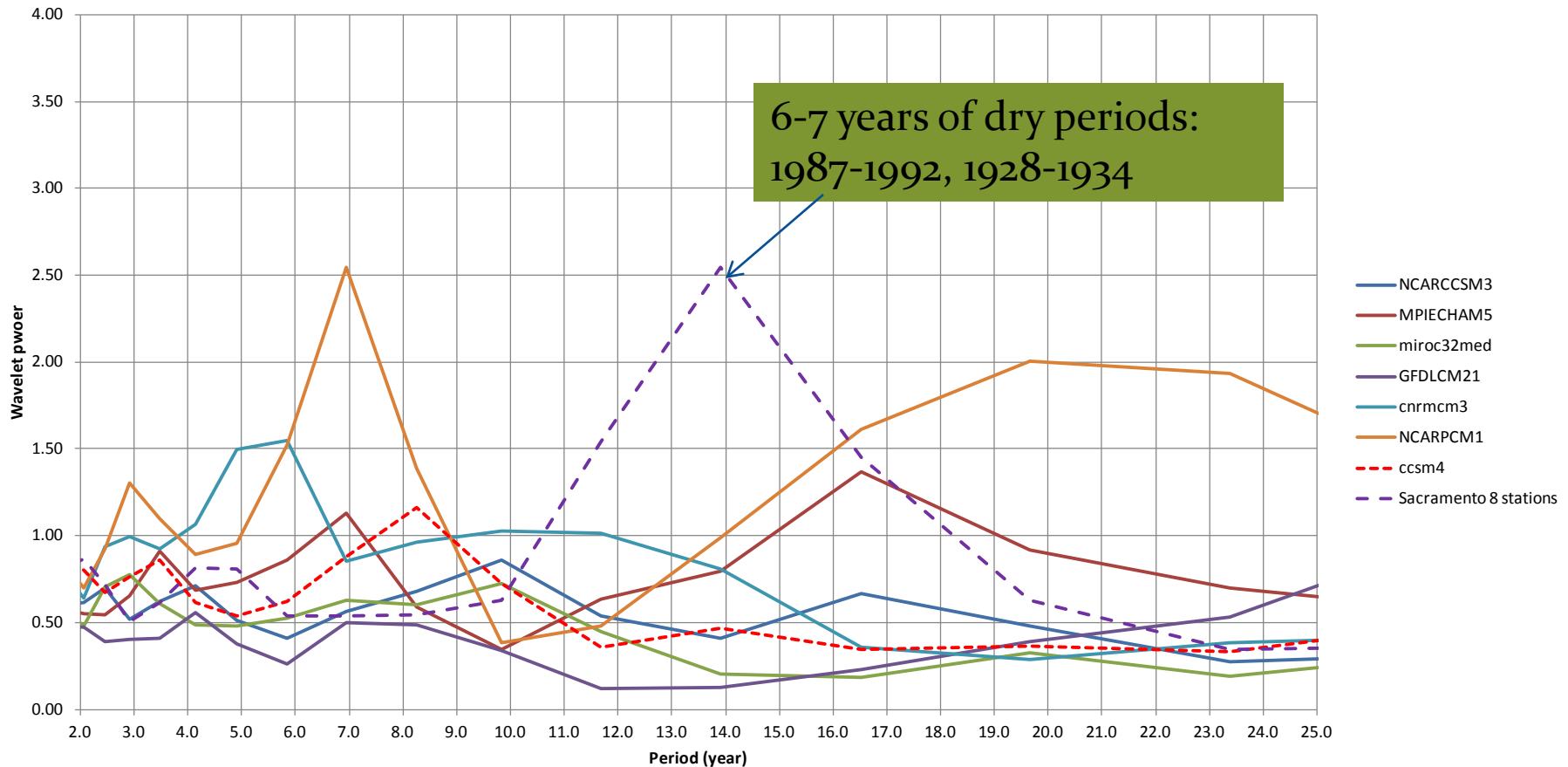
Why perturbation ratio method?

13.9 yr Quasi-Decadal Oscillation



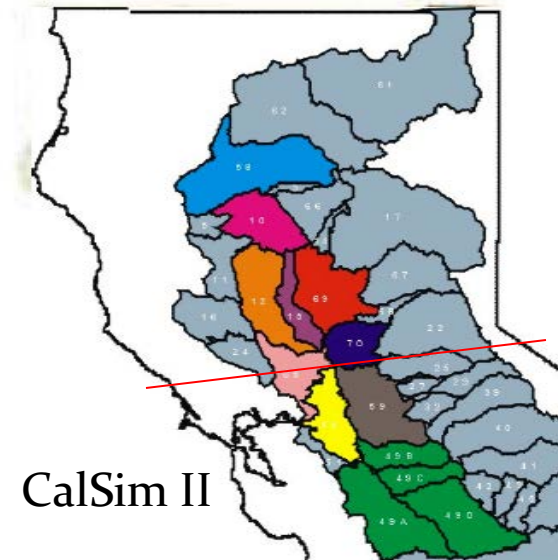
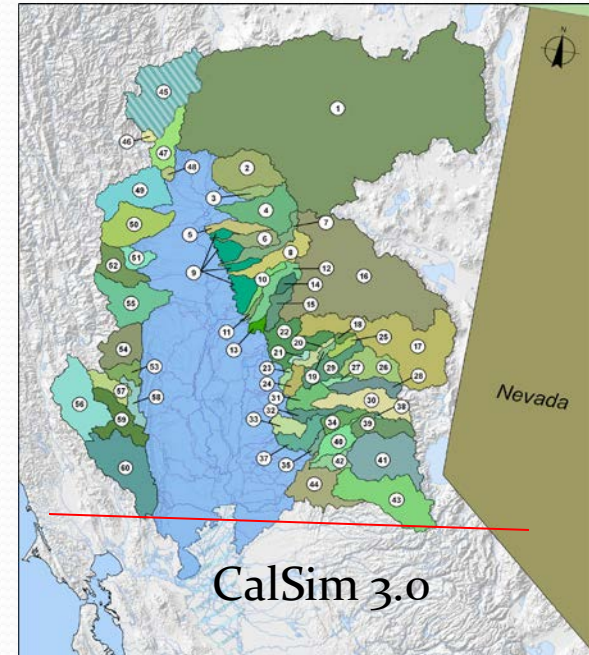
Why perturbation ratio method?: GCM issues

Wavelet Power (normalized with Variance) for GCMs and Observed Precipitation
(near Folsom Lake)



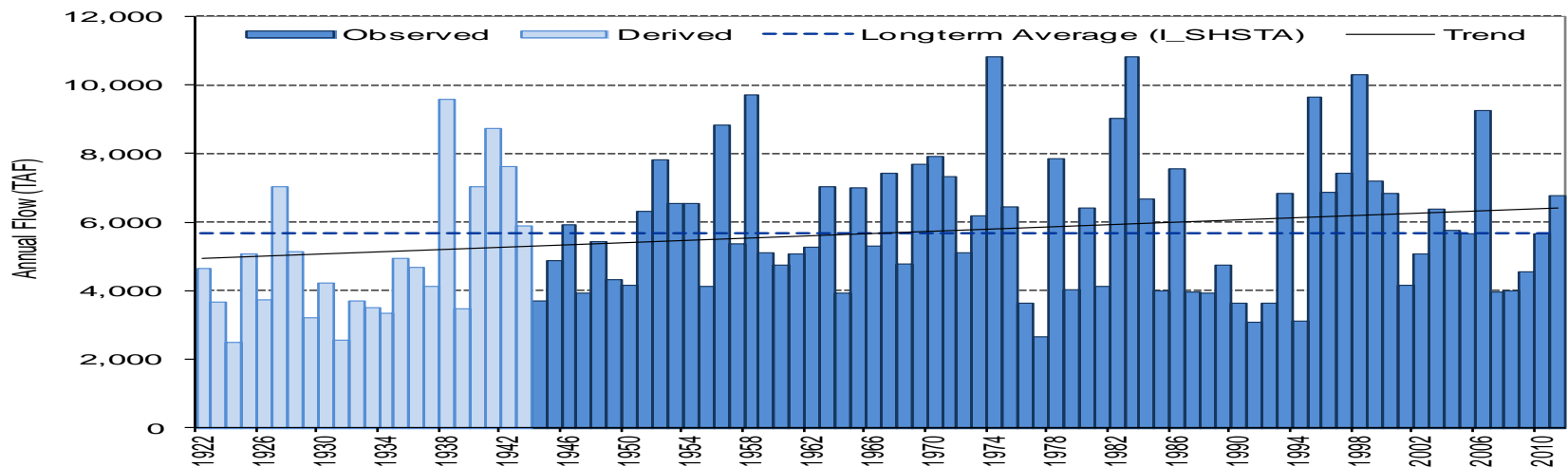
CalSim 3.0 vs CalSim II

- Increased spatial **resolution** in rim (boundary) watersheds
- Expanded representation of **unimpaired flows** from rim watersheds
- More consistent and transparent representation of **Central Valley floor hydrology**
- Coupled representation of surface water and **groundwater**



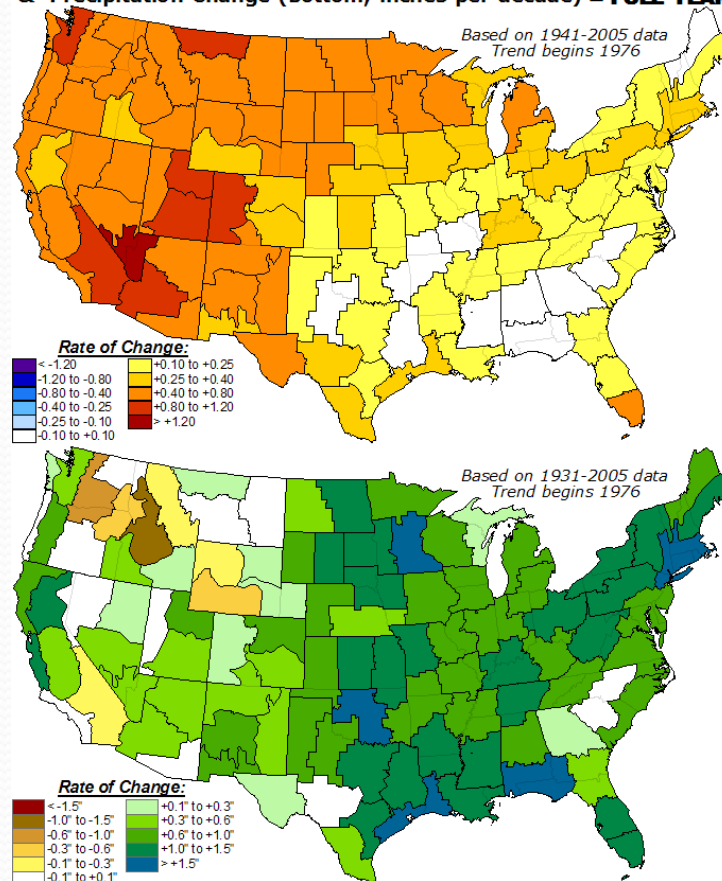
Refine CC Impact Study from Step 1 to Step N: Cull GCMs

- Culling of GCMs
 - Interannual variability: 13.9 yr (QDO), ENSO, and PDO
 - Trend
 - Trend Difference in N. California and S. California
- Ensemble-based or Probability-based Study Approach—at least 30 GCM Projections for each scenario or RCP (Why 30?--->The Central Limit Theorem (CLT))
- CMIP3 and CMIP5

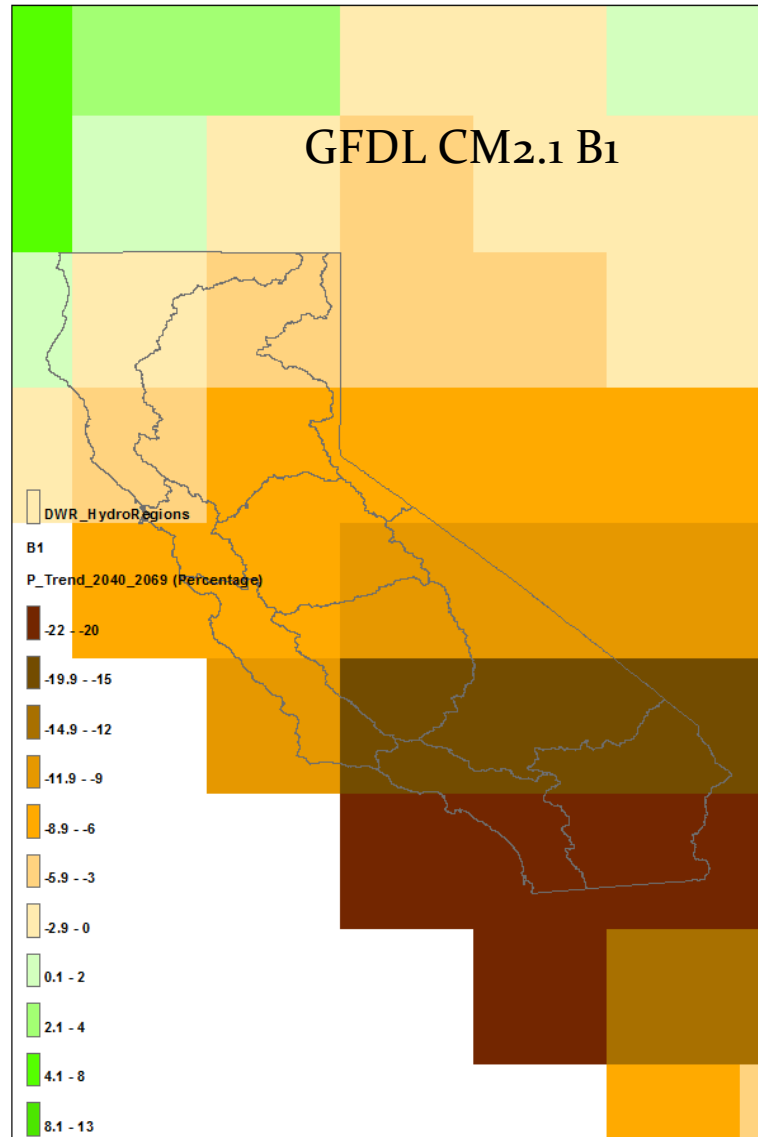


Long term Linear Trend

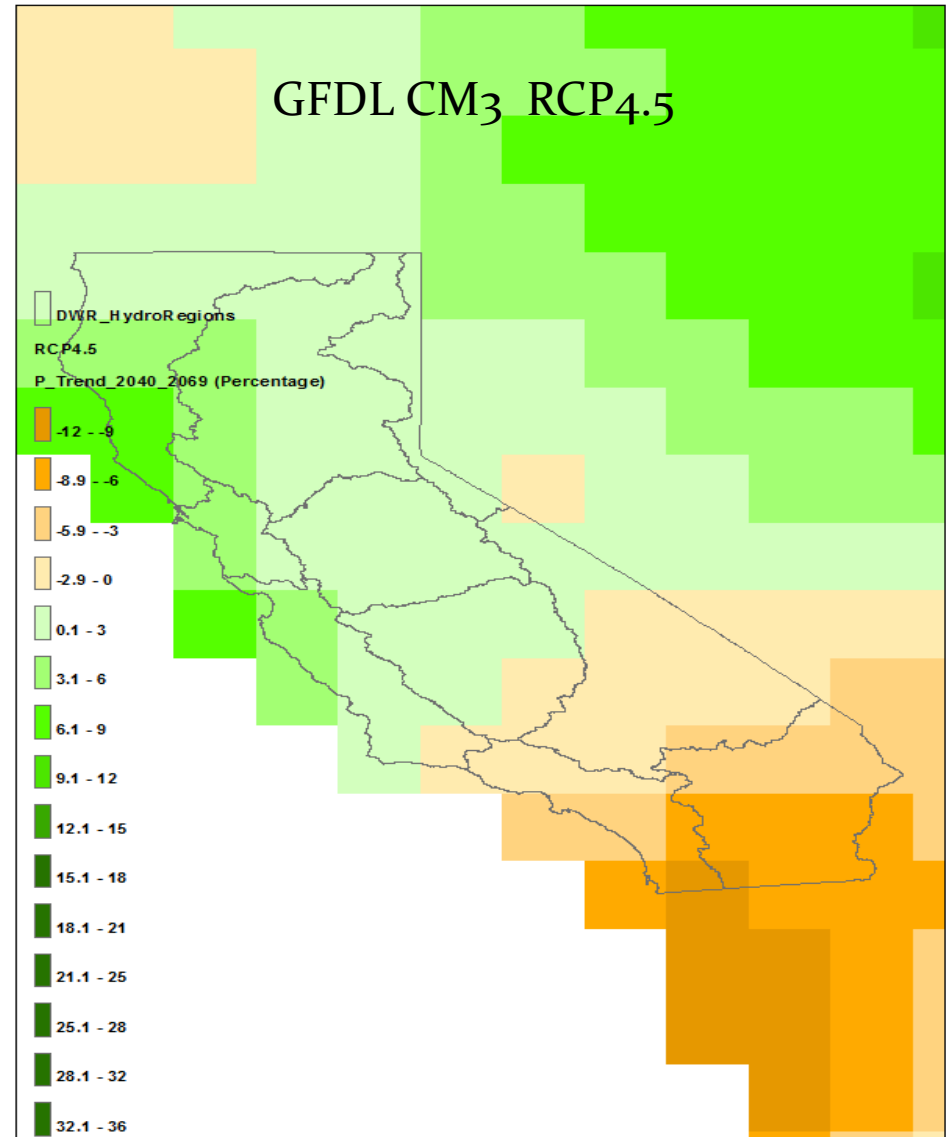
Rate of Long-Term Trend Temperature Change (top; °F per decade)
& Precipitation Change (bottom; inches per decade) – **FULL YEAR**



CMIP₃

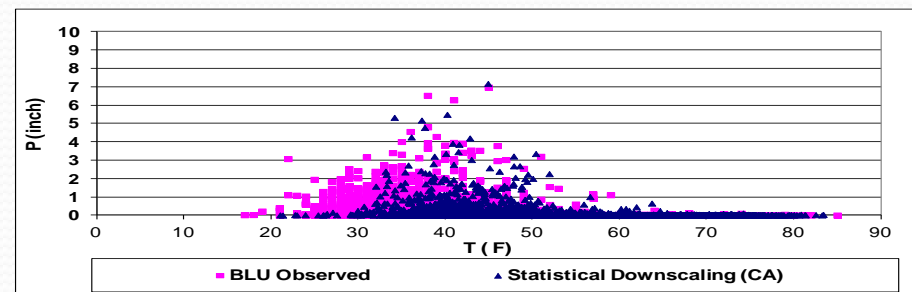
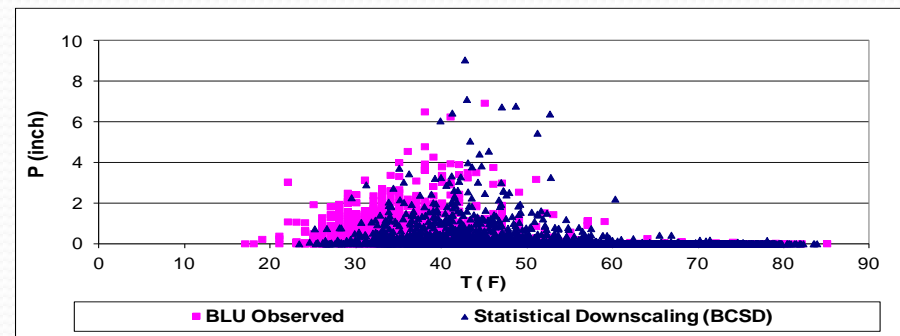
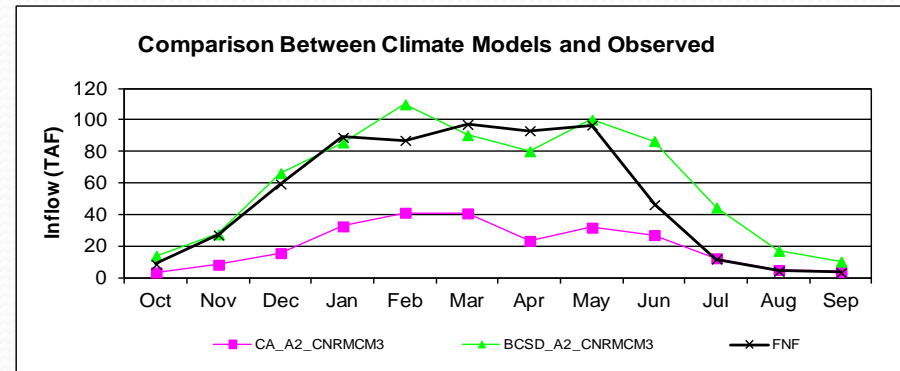
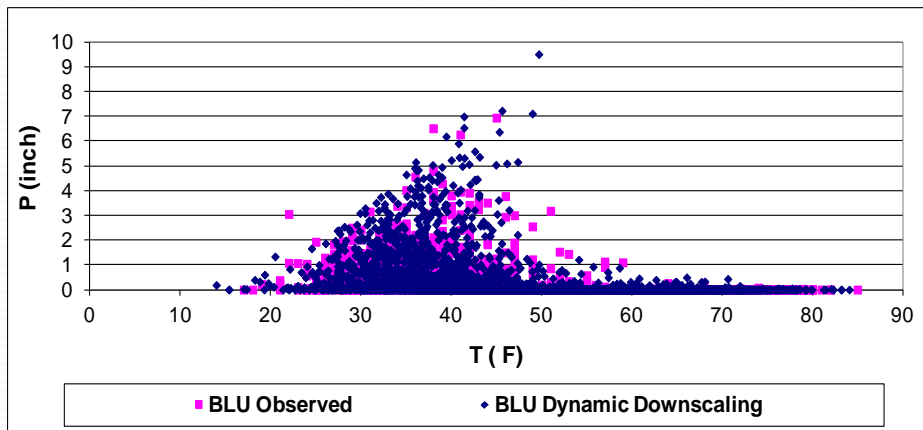


CMIP₅



Refine CC Impact Study: Culling Downscaling Products

- Uncertainties in Statistical/Dynamic Downscaling Product
 - Mass Conservation
 - P and T Interdependency
 - Trend Preservation



Other Refining Approaches for CC impact study

- Variable Sea Level Rise
- More Coverage of Routed Inflow in VIC
- Variable Perturbation Ratio Method
- Climate Change Impacted Water Demand

